REMARKS

This is a full and timely response to the non-final Official Action mailed **September 24, 2007** (the "Action" or "Office Action"). Reconsideration of the application in light of the following remarks is respectfully requested.

Claim Status:

Claims 1-50 are currently pending for further action. No amendments are proposed by the present paper.

Prior Art:

Claims 1-4, 10-12, 17-22, 28-30, 35-38 and 44-46 were rejected as unpatentable under 35 U.S.C. § 103(a) over the combined teachings of U.S. Patent App. Pub. No. 2003/0090597 to Katoh et al. ("Katoh") and U.S. Patent No. 6,407,726 to Endo et al. ("Endo"). For at least the following reasons, this rejection should be reconsidered and withdrawn.

From the recent Office Action, the Examiner appears not to understand the concept of "wobulation." Consequently, starting with the basics, we define "wobulation."

> Wobulation works by overlapping pixels. It does so by generating multiple sub-frames of data while an optical image shifting mechanism (e.g. the mirror of a digital micromirror device) then displaces the projected image of each sub-frame ***by a fraction of a pixel (e.g. one-half or one-third)***. The sub-frames are then projected in rapid succession, and appear to the human eye as if they are being projected simultaneously and superimposed. For example, a high-resolution HDTV video frame is divided into two sub-frames, A and B. Sub-frame A is projected, and then the miniature mirror on a digital micromirror device switches and displaces sub-frame B one half pixel length as it is projected. When projected in rapid succession, the sub-frames superimpose, and create to the human eye a complete and seamless TV image. If the video sub-frames are aligned so that the corners of the pixels in the second sub-frame are projected at the centers of the first, the illusion of double the resolution is achieved, like in an interlaced CRT display. Thus a lower resolution fixed pixel

> device using wobulation can emulate the picture of higher resolution fixed device, at a reduced cost.

(Wikipedia.org, "wobulation") (emphasis added) (see also, Applicant's specification, paragraph 0024).

The Examiner appears to be under the mistaken impression that the Katoh system performs wobulation. (Action, p. 3). This is incorrect. Kathoh does not teach or suggest a wobulation system. Katoh does not even mention wobulation. Rather, Katoh teaches an entirely different technique that is used for blending colors, not enhancing resolution.

The Katoh technique does involve shifting or displacing sub-frames of a projected image, as occurs in wobulation. However, in Katoh, the shifting is always ***by an integer pixel amount*** such that two different colors are projected to a single pixel to produce a blended color result for that pixel. (Katoh, paragraph 0041). This increases the color range of the display device.

If the Examiner will read Katoh, this is made clear. According to Katoh,

> each image subframe on the projection plane is made up of pixels representing the color of the R, G or B light ray. However, the R, G and B image subframes are displayed time-sequentially at very short time intervals, which are even shorter than the time resolution of the human visual sense. Consequently, a color image is recognized by the human eyes as an afterimage.
>
> In contrast, according to the present invention, each image subframe is formed by combining the R, G and B light rays with each other as will be described in detail later. That is to say, in a subframe period, the projection plane is irradiated with the R, G and B light rays that have been modulated by the image display panel. *Each of the R, G and B light rays that have been modulated by the image display panel irradiates one position on the projection plane in one subframe period but irradiates another position on the projection plane in the next subframe period.* Then, those light rays are synthesized together with time, thereby displaying a full-color image frame thereon.

(Katoh, paragraphs 0155-6) (emphasis added).

This is ***not*** wobulation.

Part of the confusion occurs because of the term "sub-frame." In Katoh, sub-frames are separate color components of an image. When successive colored sub-frames are shifted

by whole pixel amounts, different blended colors result in what is seen by a human observer. (Katoh, paragraphs 0155-6). Thus, Katoh teaches shifting the position of an R, G or B color sub-frame in successive "subframe periods" for the purpose of merging colors.

By way of contrast, in wobulation, the wobulation sub-frames are not different color components. This is because enhanced resolution is being achieved, not color blending. In wobulation, if the display is color, the full color frame is first divided into color components. Then, the single color sub-frame is further divided into wobulation sub-frames.

A "wobbling device shifts the pixels such that each wobulation sub-frame is displayed by the display optics (105) in a slightly different spatial position than the previously displayed image sub-frame. The wobbling device (104) may shift the pixels such that the image sub-frames are offset from each other by a vertical distance and/or by a horizontal distance." (Applicant's specification, paragraph 0033). This shifting results, as indicated, in the perception by the viewer of enhanced resolution, i.e., a greater number of pixels than actually exist, with fewer pixel inaccuracies. The wobulation sub-frames mentioned are created specifically for the wobulation technique being performed and are not dependent on or necessarily related to the color components of an image frame.

Consequently, Katoh does not teach or suggest anything relevant to how wobulation sub-frames, as opposed to color component sub-frames, are generated. Katoh has nothing to do with wobulation.

On the other hand, the Endo reference does describe a wobulation system, but does not teach or suggest the wobulation system recited by the Applicant. The Office Action assumes incorrectly that the teachings of Endo regarding wobulation are relevant to the teachings of Katoh. Once it is understood that Katoh does not teach or suggest a wobulation system, the proposed combination of teachings from Katoh and Endo is clearly unreasonable

and would not have been considered by one of skill in the art who would understand that Katoh has nothing to do with wobulation.

Turning to the claims themselves, claim 1 recites:

> A display system for displaying an interlaced image frame, said interlaced image frame comprising a top field and a bottom field, said top and bottom fields each having lines of pixels, said system comprising:
> an image processing unit configured to process a stream of pixel data elements sequentially corresponding to said pixels in said top and bottom fields and generate a number of image sub-frames;
> a modulator configured to generate a light beam bearing said number of image sub-frames: and
> a wobbling device configured to displace said light beam such that each of said image sub-frames is spatially displayed offset from a previous image sub-frame by an offset distance less than a pixel width;
> *wherein at least one of said image sub-frames is generated using only said pixel data elements in said top field and at least one of said image sub-frames is generated using only said pixel data elements in said bottom field.*

(Emphasis added).

In contrast, Katoh and Endo do not teach or suggest the claimed display system, "wherein at least one of said image sub-frames is generated using only said pixel data elements in said top field and at least one of said image sub-frames is generated using only said pixel data elements in said bottom field." This subject matter is entirely outside the scope and content of the cited prior art.

Applicant's claim 1 recites a new relationship between the fields of an interlaced video signal and the sub-frames generated *for wobulation*. Specifically, rather than converting the interlaced video to progressive video so that it can be processed similar to any other image frame, claim 1 recites that at least one image sub-frame is formed using only data from a specific, i.e., top field, of an image frame and another at least one image sub-frame is formed using only data from a specific, i.e., bottom field, of the image frame. The cited prior art does not remotely suggest this subject matter.

On this point, the recent Office Action cites Katoh at paragraphs 0174 and 0176. (Action, p. 3). These paragraphs talk about how the Katoh color blending system could be implemented with interlaced video. In context, the cited portions of Katoh state the following:

> [0174] It should be noted that if the panel 8 is driven by an interlaced scanning technique, the scan lines on the screen are grouped into even-numbered lines and odd-numbered lines. In the interlaced scanning, either all of these even-numbered scan lines or all of these odd-numbered scan lines are alternately activated. Accordingly, Γ={fraction (1/30)} second.apprxeq.33.3 milliseconds. Also, the time allotted to each of the even- and odd-numbered fields that make up one frame (i.e., one field time period) is {fraction (1/60)} second.apprxeq.16.6 milliseconds. ...
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> [0176] For example, suppose an image represented by a frame (i.e., an image frame) is as shown in (a) of FIG. 4. This image frame should be displayed in full colors, and the colors of the respective pixels are determined in accordance with the data defining this image frame. It should be noted that in the interlaced scanning technique, an image represented by a field may be processed similarly to an "image frame" as used herein.
>
> [0177] The conventional three-panel projection type image display device separates the data into three data subsets corresponding to the R, G and B light rays for the respective pixels, thereby generating three data subsets representing the R, G and B image frames as shown in (b), (c) and (d) of FIG. 4. ...
>
> [0179] ***In contrast, unlike any of these conventional techniques, the single-panel projection type image display device of this preferred embodiment sequentially illuminates the same area on the projection plane 13 with the R, G and B light rays that have been modulated by mutually different pixel regions of the single image display panel 8, thereby forming a pixel on that same area. That is to say, taking an arbitrary pixel on the projection plane 13, the pixel is displayed by a method similar to the known field sequential technique. However, the method of this embodiment is entirely different from the conventional field sequential technique in that the R, G and B light rays that make up one pixel have been modulated by mutually different pixel regions of the single image display panel.*** FIG. 5(c) schematically shows how the R, G and B light rays that are irradiated time-sequentially are combined for a particular pixel on the projection plane 13 in one frame period. The three images shown on the left-hand side of FIG. 5(c) correspond to the three mutually different image subframes produced by the single image display panel 8.

(Emphasis added).

Thus, the cited portions of Katoh merely mention interlaced video in the context of the color blending technique of Katoh. This has absolutely nothing to do with wobulation or

Applicant's claimed subject matter. Katoh does not teach or suggest the claimed "display system for displaying an interlaced image frame, said interlaced image frame comprising a top field and a bottom field, said top and bottom fields each having lines of pixels, said system comprising ... wherein at least one of said image sub-frames is generated using only said pixel data elements in said top field and at least one of said image sub-frames is generated using only said pixel data elements in said bottom field."

The Endo reference similarly does no teach or suggest this subject matter. In contrast to Katoh, Endo actually is about wobulation. Consequently, Endo teaches the wobulation technique in which sub-frames are spatially displayed offset from a previous image sub-frame by an offset distance less than a pixel width. That's wobulation.

Because Katoh is not about wobulation, the teachings of Endo and Katoh are necessarily inconsistent and inapposite. This is clearly evident in the fact that Katoh expressly teaches, "[t]he shift amount of the subframes on the projection plane is preferably approximately an ***integral number of times as long as one pixel pitch*** as measured on the projection plane in the shifting direction." (Katoh, paragraph 0041) (emphasis added). This is what is required for color blending. While, on the other hand, Endo is cited for teaching the opposite, i.e., a subframe displayed spatially offset from a previous image sub-frame by an offset distance less than a pixel width. That is wobulation. The Office Action does not even attempt to address this glaring inconsistency in the two cited references or the major flaw this represents in the argument to apply Katoh to the claimed subject matter.

It is unreasonable to suggest that Katoh and Endo render claim 1 obvious.

Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in

view of the ordinary skill in the art. In the present case, the scope and content of the prior art, as evidenced by Katoh and Endo clearly did not include Applicant's claimed display system including a wobbling device that wobbulates successive subframes "such that each of said image sub-frames is spatially displayed offset from a previous image sub-frame by an offset distance less than a pixel width ... wherein at least one of said image sub-frames is generated using only said pixel data elements in said top field and at least one of said image sub-frames is generated using only said pixel data elements in said bottom field." This subject matter is entirely outside the scope and content of the cited prior art.

This difference between the cited prior art and the claimed subject matter is extremely significant. The prior art does not address or provide a technique for using wobulation with interlaced video. As demonstrated herein, Katoh teaches a color blending technique and mentions interlaced video, but the ability to use wobulation for increased resolution with interlaced video is not taught, enabled or available in the cited prior art.

For at least these reasons, Katoh and Endo will not support a rejection of Applicant's claims under 35 U.S.C. § 103(a) and *Graham*. Therefore, the rejection of Applicant's claims should be reconsidered and withdrawn.

Independent claim 18 recites:

> A method of displaying an interlaced image frame, said interlaced image frame comprising a top field and a bottom field, said top and bottom fields each having lines of pixels, said method comprising:
>
> processing a stream of pixel data elements sequentially corresponding to said pixels in said top and bottom fields and *generating a number of wobulation image sub-frames corresponding to said top and bottom fields*; and
>
> displaying each of said image sub-frames offset from a previous image sub-frame *by an offset distance less than a pixel width.*

(Emphasis added).

In contrast to claim 18, as explained above, the cited prior art, including Katoh and Endo, has not taught or suggested "generating a number of *wobulation* image sub-frames *corresponding to said top and bottom fields*" of an interlaced image frame. This subject matter is entirely outside the scope and content of the cited prior art. Therefore,, Katoh and Endo will not support a rejection of Applicant's claims under 35 U.S.C. § 103(a) and *Graham*, and the rejection of Applicant's claims should be reconsidered and withdrawn.

Independent claim 36 recites:

> A system for displaying an interlaced image frame, said interlaced image frame comprising a top field and a bottom field, said top and bottom fields each having lines of pixels, said system comprising:
>
> means for processing a stream of pixel data elements sequentially corresponding to said pixels in said top and bottom fields and *generating a number of wobulation image sub-frames corresponding to said top and bottom fields*; and
>
> means for displaying each of said image sub-frames offset from a previous image sub-frame *by an offset distance less than a pixel width.*

(Emphasis added).

In contrast to claim 36, as explained above, the cited prior art, including Katoh and Endo, has not taught or suggested "means for displaying each of said image sub-frames offset from a previous image sub-frame *by an offset distance less than a pixel width.*" To the extent Katoh is even relevant, it teaches away from this concept. Katoh further does not teach or suggest means for "generating a number of *wobulation* image sub-frames." As demonstrated above, Katoh has nothing to do with and does not mention wobulation. Katoh and Endo further fail to teach or suggest means for "generating wobulation image sub-frames for wobulation where the image sub-frames correspond to top and bottom fields of an interlaced image frame."

This subject matter is entirely outside the scope and content of the cited prior art. Therefore, Katoh and Endo will not support a rejection of Applicant's claims under 35 U.S.C.

§ 103(a) and *Graham*, and the rejection of Applicant's claims should be reconsidered and withdrawn.

Additionally, as would be expected, the various dependent claims of the application recite additional subject matter that is not taught or suggested by Katoh. For example, claim 2 recites "wherein said image processing unit is configured to process said pixel data elements in said top field to generate a first image sub-frame and said pixel data elements in said bottom field to generate a second image sub-frame." In this regard, the misguided Office Action cites a portion of Katoh (paragraph 0026) that describes the conventional method of generating sub-frames from a non-interlaced video frame without reference or regard to the fields of an interlaced image frame. (Action of 5/2/07, p. 5). Consequently, the cited portion of Katoh clearly has nothing to do with the subject matter of claim 2.

A similar example could be made for virtually any of the dependent claims of the application given the utter inapplicability of Katoh to the claimed subject matter.

Claims 5, 23 and 39 were rejected as being unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Katoh, Endo and U.S. Patent No. 6,680,748 to Monti ("Monti"). Claims 6-9, 13-16, 24-27, 31-34, 40-43 and 47-50 were rejected as being unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Katoh, Endo and U.S. Patent No.5,581,302 to Ran et al. ("Ran"). These rejections are respectfully traversed for at least the same reasons given above with respect to the independent claims of the application.

Conclusion:

In view of the foregoing arguments, all claims are believed to be in condition for allowance over the prior art of record. Therefore, this response is believed to be a complete response to the Office Action. However, Applicants reserve the right to set forth further arguments supporting the patentability of their claims, including the separate patentability of the dependent claims not explicitly addressed herein, in future papers. Further, for any instances in which the Examiner took Official Notice in the Office Action, Applicants expressly do not acquiesce to the taking of Official Notice, and respectfully request that the Examiner provide an affidavit to support the Official Notice taken in the next Office Action, as required by 37 CFR 1.104(d)(2) and MPEP § 2144.03.

If the Examiner has any comments or suggestions which could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the number listed below.

Respectfully submitted,

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